

REMARKS/ARGUMENTS

35 USC § 103

Claims 1-15 were rejected under 35 USC § 103 as being obvious over Bradbury et al. (U.S. Pat. No. 5,306,400) in view of Velin et al. (WO02/40406). The Applicant respectfully disagrees, especially in view of the amendments herein.

As amended herein, claim 1 expressly requires a step of "...subjecting the solution to an electrochemical reduction...wherein the solution has a *nitrate concentration of at least 500 mg/l and a metal halide content of at least 10 wt% prior to reduction...*" and a step of "...subjecting the solution...to an electrochemical oxidation *in the presence of the metal halide to oxidize the ammonia to nitrogen, the nitrite to nitrate, and the metal halide to a metal hypohalite...*" Such steps are neither expressly nor inherently taught by Bradbury et al.

Similarly, amended claim 9 recites a step of "... eluting the nitrate anions with a metal halide eluent to thereby produce an *eluent comprising at least 500 mg/l nitrate ions and at least 10 wt% metal halide ions...*" and another step of "...transferring the eluent after reduction into an anode compartment and oxidizing at least some of the ammonia ions at the anode to form nitrogen, wherein *at least another part of the ammonia ions is oxidized using hypohalite ions that are generated at the same time at the anode from the halide ions...*" Once more, such steps are neither expressly nor inherently taught by Bradbury et al.

(1) In the office action, the examiner stated on page 3 that Bradbury discloses a method of treating a solution comprising nitrate and a metal halide, such as sodium chloride and pointed in support to col. 2, lines 56-60. The applicant respectfully disagrees and assumes that the office intended to refer to a different passage as the cited passage merely describes indirect oxidation of ammonia.. The applicant notes that Bradbury teaches in col. 4, lines 3-10 that

"... An important use for this invention is the treatment of regenerant solutions from conventional ion exchange treatment. In this application, a conventional anion exchange resin is used to treat the raw water, and when fully loaded with nitrate ions the resin is regenerated, for example with brine or sodium bicarbonate. The regenerant solution is then treated by the process of the

present invention to remove and destroy nitrate. The regenerant is then recycled for further regeneration duty..."

However, and in stark contrast to the claimed subject matter, Bradbury passes the nitrate loaded brine through the central compartment that is filled with an anionic exchange resin to so bind the nitrate to the central resin and to so regenerate the regenerant solution. In other words, the nitrate eluted from the ion exchange resin is re-adsorbed onto the central anionic exchange resin while the brine passes through the central anionic exchange. As a consequence, it is only the nitrate that is electrodialed from the central resin that is then subjected to the downstream redox process. This is clearly reflected in col. 1, lines 57-59. Thus, it should be appreciated that Bradbury only subjects nitrate to reduction and subsequent oxidation.

(2) The office further pointed to column 2, lines 55-60 in support of the presence of a step of subjecting the solution from step (I) to an electrochemical oxidation to thereby oxidize the ammonia to nitrogen. With respect to the oxidation of ammonia to nitrogen, the applicant indeed agrees. However, it is pointed out that claim 1 also requires concurrent oxidation of a metal halide to a metal hypohalite, which is not taught in Bradbury.

It is pointed out that Bradbury indeed teaches in col. 2, lines 57-60 indirect oxidation of ammonia to nitrogen using hypochlorite. However, and not surprisingly, such oxidation is stated in the alternative, which is further reinforced by the sentence spanning columns 2 and 3, reading:

"... Any ammonia which is produced must be oxidized at the anode to form nitrogen according to one of the equations detailed above..."

It should be evident that Bradbury either directly oxidizes the ammonia at the anode as shown in the Figures and examples, or indirectly by reaction with a hypochloride solution. On a finer point, Bradbury also notes that:

"... Other anions in the water collect in the anode and cathode compartments and build up to the point where they are in chemical balance..."

Certainly, such teaching is inconsistent with use of the metal halide as presently claimed. Thus, it is also no surprise that Bradbury fails to make any reference to the regeneration of the

metal halide or any limited production of the metal hypohalide as expressly required in step (III) of amended claim 1.

(3) Taken the observations from (1) and (2) above, it should also be readily evident that Bradbury fails to provide any motivation to perform the reduction, oxidation, and re-reduction of the nitrogenous species in the presence of the metal halides. Indeed, Bradbury teaches against such concurrent electrochemical treatment by use of an anionic exchange resin in the center of his device. It should be noted that the presence of this anionic exchange resin is critical to Bradbury's process as the '400 patent expressly states that

"... We have now developed a method for the combined removal and destruction of nitrate ions which combines the benefits of ion exchange and electrodialysis..."

(4) As Bradbury isolates the nitrate prior to electrochemical treatment, Bradbury also fails to recognize various remarkable advantages in the process as presently claimed. First, it is noted that in the process of the '400 patent re-oxidation of nitrite to nitrate and of ammonia to nitrite is all but unavoidable. Second, due to the propensity of the nitrate and nitrite ions to migrate out of the cathode compartment, conversion efficiency is substantially reduced, which can be clearly taken from Example 1.

In contrast, where treatment solution comprises a metal halide as presently claimed, oxidation of the previously reduced brine will not only result in formation of hypochlorite, but will also oxidize undesirable nitrite back to nitrate. Moreover, the hypochlorite formed in the oxidation will concurrently assist electrode oxidation and so considerably accelerate the process.

(5) Velin et al. fails to remedy these defects. Therefore, and for at least these reasons and amendments, the combination of Velin and Bradbury fails to properly establish obviousness.

(6) Regarding the examiner's statement that Velin "...teaches the use of conventional material, such as platinised titanium and carbon materials, such as graphite which would read upon the carbon felt claimed (see page 3 third paragraph)...", it is noted that such statement is not accurate. Velin teaches:

"...Copper, lead and graphite could also be mentioned as cathode materials..."

Therefore, Velin teaches graphite, not carbon felt or carbonaceous materials as the office appears to argue. It should be noted that the difference between graphite and carbon felt is not just semantic but also structural: Graphite is a highly ordered, crystalline allotrope of carbon, whereas carbon felt is a disordered non-crystalline pyrolysis product from polyacrylonitrile. It is therefore not an equivalent choice of material. Moreover, the applicant also notes that the carbon felt material provided an unexpected result, which even further removes the claimed subject matter from the teachings of Velin. Lastly, the office failed to provide any motivation as to why the person of ordinary skill in the art would have exchanged graphite for carbon felt.

REQUEST FOR ALLOWANCE

Claims 1-15 are pending in this application, with claims 16-21 being withdrawn. The applicant requests allowance of all pending claims.

Respectfully submitted,
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